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port. This spectacle is not one that can be contemplated with equanimity by those who have faith in education and hope for its future development. We are losing the sense of perspective in educational affairs and we may not expect to elevate our colleges from a position of mediocrity in scientific training until we shall have reacquired this sense. This happy consummation is not to be attained so long as we remain in the present state of competitive hysteria or so long as we continue to provide disproportionate support for an activity that has no relation to scientific or other education except that of obstruction to it. I do not envy those colleges of the United States that are planning to sink millions in athletic stadia. I verily believe that the day will come when these colossal monuments to the suicidal folly of a so-called "educational" system will be an offense to the eyes of believers in true learning, for in that day we shall find it hard to convince our critics that we do not esteem the spectacle of two hundred and eighty minutes of actual playing of football each year as of greater importance than the training of American youth in the science of chemistry.

And now, in what way can there be any truth in the statement made in the earlier portion of this paper, to the effect that the men who are looking to the college to supply trained chemists, as well as trained scientists in other fields, are directly responsible for the continuance of this condition? Simply by this: that these people are, almost without exception, college and university alumni and that organized alumni activities concern themselves almost exclusively with efforts to further athletic successes in their colleges, to the neglect of opportunities to better educational conditions. This is certainly not because of any desire to hamper the educational work of the college. Quite the opposite is the case. They do not busy themselves so much with other modes of assistance, merely because for some reason it has not occurred to them that such assistance is possible. They believe that the college needs advertising and they have repeated so often that they nearly believe it, the old fallacy that athletic prowess is the best advertisement for institutions of higher learning.

I hope that I do not merit the appellation of "alarmist" but I do sincerely believe that the present condition and the present trend of scientific education is such as to give thoughtful people cause for concern, and I believe that we shall not get very far in our attempts to improve matters until we elect to discuss these things fearlessly and openly and then courageously to act upon our convictions. In the inspired words of Vernon Kellogg:<sup>1</sup> "It is incredible that in this all-important matter of getting our higher education straightened out we shall go on indefinitely acting as if we were helpless. Let the college or the university that wishes to do the greatest thing just now to be done for higher education and true learning in America step forward and boldly do the unusual thing. Let it devote the most of its energies to the most important part of its work. It will soon not be alone in its doing. It will become a prophet with honor in its own land."

The choice of courses is now ours. If we fail to exercise that choice in the name of true education and true science, we may later find that the decision has passed from our grasp. Or can it be that, as history has so often recorded of individuals, of organizations and of nations, we shall continue simply to drift until the accumulation of disaster shall shock us into realization?

E. G. MAHIN

### BUGS AND ANTENNAE<sup>1</sup>

Members of the Entomological Club of Madison, entomologists in various parts of the United States, and radio "bugs":

The Madison Entomological Club, as host,

<sup>1</sup> SCIENCE, 54: 19 (1921).

<sup>1</sup> A radio lecture given at the request of the Entomological Club of Madison, Wis., and broadcasted from the General Electric Company's station, "WGXY," at Schenectady, N. Y., at 9 P.M., April 24, 1922. The transmission to Morgantown, W. Va., about 400 miles, was practically perfect, it being as distinct as though presented in a classroom. Unfortunately static or other conditions prevented it being heard at Madison, Wis., and seriously interfered at New Haven, Conn., and Wooster, Ohio.

welcomes all who listen in. It is a great pleasure in this first radio entomological lecture to be specifically authorized to convey to Madison entomologists and others the greetings and best wishes of Dr. Howard, chief of the Federal Bureau of Entomology, Dr. Gibson, Dominion entomologist of Canada, and the presidents of the older entomological societies on the eastern coast, namely, Cambridge, New York, Brooklyn, Washington and Philadelphia, the last founded in 1859, the oldest of its kind in the country and with its founder, Ezra T. Cresson, still active. The pioneer and veteran entomologist of Canada, Dr. Bethune, has authorized the extension of his congratulations and best wishes to present day workers. We would also express our appreciation to the General Electric Company of Schenectady for placing this lecture upon its program.

There are great possibilities in broadcasting and, for the purpose of determining its present value, the speaker requests reports by mail giving the number of entomologists at each unit receiving this lecture. Crop and market reports are broadcasted. Why not warnings of insect depredations? Regional programs and lectures by visiting specialists are very desirable present day possibilities.

This has been called the age of man. Is it not really the age of insects? They occur almost everywhere. They actually imperil our existence by attacking crops, destroying forests, annoying and worrying domestic animals, and are well known carriers of deadly infections, such as typhoid fever, yellow fever, cholera and sleeping sickness. Were it not for the beneficent activities of birds and many other natural agents, we would be overwhelmed by the numerous pests contemptuously designated as bugs. There are in New York State some 20,000 different species of insects and perhaps 100 entomologists engaged in collecting and studying them. There are presumably more than 100,000 species in the United States with over 1,000 entomologists and in the entire world a million to ten million different species of insects (a large proportion unknown) and a relatively much smaller group engaged in their study. Each of these insects occurs in four distinct stages, namely, the egg,

the maggot or caterpillar, the pupa or chrysalis and the adult or perfect insect, consequently the entomologists of the world are engaged in the stupendous task of classifying and learning the habits of four to forty million different forms. Accurate differentiation must precede investigation of life histories, otherwise deplorable confusion is almost inevitable. There is no group in the animal, the vegetable or the inorganic kingdoms which presents so many diversities as the exceedingly numerous and varied forms known as insects. It usually takes several years and frequently much longer to work out a satisfactory life story of even one insect, consequently a limitless field is before us. We extend to radio "bugs" and others interested an invitation to join in exploring and making known this vast realm of the undiscovered.

Man is inclined to congratulate himself upon his wonderful progress, forgetting that in many cases he has yet to reach the degree of perfection seen in numerous animals. The recently developed monoplane, for example, does not differ greatly in its general proportions from those of our hawk moths, and the biplane is almost a duplicate of a pair of dragon flies, one flying above the other; both models that have been favorites in the insect world for thousands of years. Dare any man say that our latest advancement in applied science, namely, the radio telephone, is more than a relatively crude modification of methods which have been used by insects for countless ages?

Radio "bugs" are rightfully proud of their aerials or antennæ, yet they have developed relatively few types and apparently have not learned, except in a very general way, of the million or more different kinds of insect antennæ, each admirably adapted to a specific purpose and some wonderfully suggestive of aerial communication.

Ages ago the gall midges, minute flies which produce galls on many plants, learned the advantages of elevated or elongated antennæ and we find here species which have solved the problem by the development of greatly elongated antennal segments, thus increasing very materially the length of the entire organ and others which have attained the same end

through a doubling or trebling of the normal number of segments or joints. As a result, some have antennæ twice as long as the body. Each segment is a unit and though the comparison may not be a strictly accurate one, we are inclined to regard the antennal segments as linked in multiple units.

It is well known that the antennæ of many insects have very efficient olfactory and auditory structures. The latter may be simple hairs springing from sensory pits, whorls of hairs or even more complex structures.

The radio enthusiast would certainly be interested in an aerial or antenna of the multiple inverted umbrella type, the arms of the umbrellas being loops and in some forms greatly extended on one side, presumably for directive receiving; the umbrellas arranged in double or triple series in multiple units mounted with flexible connections and an articulate base permitting limited rotation. Such structures are found in gall midges.

We would call attention to the peculiar circumfila or encircling threads supported by numerous short stems entering sensory pits or detectors, the latter within the antennal segments. The simplest type of circumflum is a low thread or circle, not a coil, near the base of the segment and frequently connected by a filament on one face with a similar circle near the opposite extremity. These threads may be modified and follow a sinuous or wavy course instead of a straight one; they may be greatly increased in number to form an enclosing net work, suggestive of the bed spring aerial; the portions between the supporting stems may be greatly stretched or drawn out as it were to form relatively enormous loops and in some we have the loops on one side of the antennæ very greatly produced. We may even find in some antennæ a combination of the low and simple type together with highly developed loops. There is one group where these structures are modified in such a curious way as to resemble miniature horse shoes upon opposite sides of each segment; the supporting stems suggesting the nails used for the attachment of horse shoes.

There are over a thousand variations in gall midge antennæ, presumably for cause. Solomon advised some of his fellow mortals to con-

sider the ant. May we suggest to radio enthusiasts a similar attitude toward gall midges—master builders of antennæ which are both the admiration and despair of man.

Concluding, may we register faith in radio and radio antennæ, anticipating through them closer and more helpful relations with fellow men.

E. P. FELT

STATE ENTOMOLOGIST  
OF NEW YORK

### JOHN CASPER BRANNER

THE following resolution was passed at a meeting of the Academic Council of Stanford University held April 7, 1922:

As witness of our affection for Dr. Branner and respect for his memory, we desire to make our own and incorporate (in part) in the minutes of the Academic Council the appreciation prepared for the *Illustrated Review* by his friend and colleague, Professor Stillman:

"In the death on March first of President Emeritus John Casper Branner, Stanford University loses one of its most distinguished scholars, one of its greatest teachers and most respected and beloved personalities.

"Dr. Branner was born in New Market, Tennessee, on July 4, 1850. He attended school at Maury Academy in Dandridge, Tennessee, and later enrolled at Maryville College. At the age of eighteen he entered Cornell University, where he received his bachelor's degree.

"While still an undergraduate he was selected (1875) by Professor Charles F. Hartt to assist him in a geological survey of Brazil, which occasioned several years of work in Brazilian geology. In 1882 he was again commissioned, by the United States Government, to go to South America to investigate insects injurious to cotton and sugar-cane industries. From 1883 to 1885 he was engaged by the Pennsylvania Geological Survey to make a topographic map of the Lackawanna Valley.

"When David Starr Jordan became president of the University of Indiana in 1885, he appointed his Cornell college and fraternity mate to the professorship of geology at that institution, a position he held until again called by Dr. Jordan to the similar chair in Stanford University. In the meantime he acted (1887-1892) as state geologist of Arkansas, while retaining his chair at Indiana.

"From 1891 until his retirement from the uni-